(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 343 302 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
10.09.2003 Bulletin 2003/37

(21) Application number: **01980145.5**

(22) Date of filing: **19.07.2001**

(51) Int Cl.[7]: **H04M 11/06**

(86) International application number:
PCT/CN01/01185

(87) International publication number:
WO 02/049337 (20.06.2002 Gazette 2002/25)

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **14.12.2000 CN 00136229**

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(54) TRANSMISSION METHOD OF SEVERAL SERVICES COMBINATION

(57) A transmission method of multiple services combination is as follow. During service initialization of both communication sides, an identical TFCS (Transport Format Combination Set), containing all TFC (Transport Format Combination), is created in both sides. When a data is transmitted according to specific TFC at the transmitting end, a corresponding TFCI (Transport Format Combination Indicator) of the TFC is transmitted simultaneously. At the receiving end, the TFCI is used to look for the TFC in the TFCS. The TFCS is divided into no less than one sub-sets according to the specific channel characteristics of the service. TFCI is only used for looking for TFC in a sub-set, but not used to indicate the sub-set where the TFC is located. When data of services are transmitted with TFC at the transmitting end, the service specific channel characteristics are used to define a sub-set where the TFC is located at the receiving end, and the TFCI is used to look for the TFC in the sub-set.

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Description

Field of the Technology

[0001] The invention relates to telecommunication technical field, especially to a transmission method of multiple services combination in a telecommunication system with parallel transport.

Background of the Invention

[0002] In modem telecommunication system, transmission method taking time-slot, frame or multiple frames as a unit is popular. In order to transmit data of multiple services simultaneously, it is necessary to combine (to multiplex) data of various services in a certain format at the transmitting end, and to de-multiplex received data of various services with the same format at the receiving end. At transmitting end, combined data and its combination format information are sent simultaneously, and at receiving end, the received data are de-multiplexed according to the received combination format information.

[0003] Specially speaking, in present transmission methods of multiple services combination, such as initialization of services between a base station and a mobile, an identical set including all transport formats combination is created at both sides, which is called Transport Format Combination Set (TFCS). When data of services are transported according to certain Transport Format Combination (TFC) at the transmitting end, a Transport Format Combination Indicator (TFCI) is transported simultaneously. The TFC may include multiplex mode, characteristics of the service, such as coding mode, etc. At the receiving end, the TFC of the received data is looked for in the TFCS according to the received TFCI, and then the received data are properly processed based on the TFC.

[0004] In order to satisfy requirement of multiple services, TFCI must be updated with certain rate, usually at least once in 10ms. Therefore, transmission of TFCI occupies a larger part of channel resource. For example, in the TD-SCDMA scheme of CWTS (China Wireless Telecommunication Standard) there are 64 chips for TFCI transmission of each time-slot.

Summary of the Invention

[0005] The invention is to provide a transmission method of multiple services combination, in order to decrease channel resource used by TFCI and increase its update rate.

[0006] A transmission method of multiple services combination is that during service initialization of both communication sides, an identical TFCS, containing all TFC, is created in both sides; when a data is transmitted according to a specific TFC at the transmitting end, a corresponding TFCI of the TFC is transmitted simultaneously; at the receiving end, the TFCI is used to indicate the TFC in the TFCS. It is characterized that said TFCS is divided into no less than one sub-sets according to the specific channel characteristics of the service, and the TFCI is only used for looking for TFC in a sub-set, but not used to indicate the sub-set where the TFC is located; when services are transmitted according to the TFC at the transmitting end, at the receiving end the services specific channel characteristics of this time are used to define a sub-set where the TFC is located, and the TFCI is used to look for the TFC in a sub-set.

[0007] It is better, the TFCI transmission mode of every sub-set can be identical or different, which can be based on TFCI bits mode, and/or TFCI coding mode, and/or physical time-slot mapping mode of TFCI, and.

[0008] It is better, when services are transmitted at the transmitting end according to a TFC of a specific sub-set, the sub-set at the receiving end, where the TFC is located, and the corresponding TFCI transmission mode can be defined according to the service specific channel characteristics of this time.

[0009] It is better, said different sub-sets of the TFC can have or cannot have overlap part.

[0010] It is better, said specific channel characteristics of a service that is used to divide the TFCS into no less than one sub-set and said specific channel characteristics of a service that is used to define the sub-set, where the TFC is located at the receiving end, can be identical or different, but they essentially define to the same sub-set.

[0011] It is better, said specific channel characteristics of a service that is used to divide the TFC set into no less than one sub-set can be number of time-slots, and/or number of channels, and/or spreading factor, and/or data transmission rate.

[0012] It is better, said specific channel characteristics of a service that is used to define the sub-set, where the TFC is located, at the receiving end, can be number of time-slots, and/or number of channels, and/or spreading factor, and/or data transmission rate.

[0013] The invention divides TFCS into sub-sets. Since number of TFC in a sub-set is less, so number of bits of corresponding TFCI is less. At the receiving end, one or multiple specific channel characteristics, such as number of time-slots, number of channels, spreading factor, data transmission rate etc., can be used to define the sub-set. In addition, they can be further used to define the bits number of TFCI of the sub-set. In this way, the TFCI can be correctly received.

[0014] The invention can obviously decrease number of bits used to represent TFCI, so channel resource used to transmit TFCI can be saved. Comparing with the present technique, under the same channel resource, the invention obviously decreases number of bits used to represent TFCI, and increases its update rate.

Embodiments of the Invention

[0015] The invention will be described in more detail, hereinafter, with reference to embodiments. It should be understood that the embodiments are only for description of the invention, which are by no means to limit the invention.

[0016] In the present technology, the transmission method of multiple services combination is as follow. At the initialization of a service, an identical TFCS , which includes all TFC, is created at both sides of the communication. When data of services are transmitted according to a specific TFC at the transmitting end, a corresponding TFCI of the TFC is transmitted simultaneously. At the receiving end, the TFC of the received data is looked up in the TFCS with the received TFCI.

[0017] For a single service, it is possible there are several formats. For multiple services, the formats combination is possibly much more, so the TFCS is larger. In order to define a TFC in the TFCS , it is needed to have more bits for TFCI, such as 10 to 12 bits. Furthermore, the TFCI must be updated with a certain rate to satisfy various service requirements. Therefore, the transmission of TFCI occupies a bigger part of the channel resource.

[0018] For example, in the TD-SCDMA scheme proposed by CWTS, each time-slot has 64 chips for TFCI transmission. Even though, for a service, which occupies fewer time-slots in each sub-frame, the update rate of TFCI is not satisfied, because it can only transmit fewer chips in each sub-frame. For example, suppose a service occupies only one time-slot for every sub-frame, then there are only 64 chips for TFCI in every sub-frame. Suppose the bits number for TFCI is about 12, after coded with Reed-Muller code it is 32 bits. When the spreading factor is 16, it is needed to transmit eight sub-frames to update TFCI once, because every sub-frame can only transmit 64 chips. It is not satisfied that TFCI need to be updated once every 10ms. If solving this problem by increasing chips number occupied by TFCI in every time-slot, in the situation that there is more time-slots number or lower spreading factor, TFCI will occupy too much resource and channel resource is wasted.

[0019] The invention decreases channel resource occupation for transmission of TFCI by decreasing bits number of TFCI. The main idea of the invention is to divide the TFCS into several sub-sets by using specific channel characteristics of services. The specific channel characteristics can be, for example, number of time-slots, spreading factor, number of channels and data transmission rate, etc. Each TFCS sub-set has a corresponding TFCI bits number, and the TFCI bits number for different TFCS sub-set can be identical or different. Said TFCI bits number is only used for accurately looking for TFC in a TFCS sub-set, and without any indication about which sub-set the TFC belongs to. In this way, the bits number of TFCI can be decreased. In the receiving end, the specific channel characteristics such as number of time-slots, spreading factor, number of channels and data transmission rate, etc., can be used to separate different sub-sets of TFCS. Other channel characteristics can also be used for separating different sub-sets of TFCS, as long as the channel characteristics can define a sub-set division of TFCS same as these specific channel characteristics do.

[0020] Data transmission rate of services with various transport formats combination usually varies in a larger scope, for example, the IMT2000 supports that a service can have data transmission rate from several Kbit/s to 2Mbit/s. In real, by using such as rate matching techniques, data transmission rate in a communication system can be unified to some discrete values, which are easily processed in the physical layer. Therefore, the data transmission rate can be used to divide TFCS into sub-sets. Specifically speaking, data transmission rates of services with TFCs in the TFCS can be sorted from high to low, and the TFCS can be divided into several sub-sets in an appropriate way. For example, taking every sub-set with same number of TFC, so the bits number of TFCI for each sub-set is identical. Consequently, at the receiving end, during initialization, the bits number of a TFCI is known, and the TFC mapping to the TFCI can be known too. In this way, dispensing with the detection for the bits number of a TFCI and TFC mapping to the TFCI in the receiving end, the system design is simplified in a certain degree.

[0021] Another example, the data transmission rate can be evenly divided into several sections, and TFC of services in same data transmission rate section belongs to a same sub-set. In this case, the TFC number in a sub-set is related to the transmission rate. In general, a sub-set corresponding to services with lower data transmission rate has less number of TFC, and a sub-set corresponding to services with higher data transmission rate has more number of TFC. This means that a sub-set contain TFC with lower transmission rate has fewer number of bits for TFCI, and a sub-set contain TFC with higher transmission rate has more number of bits for TFCI. This is suitable for the following rule. In every frame (sub-frame), less resource (such as time-slot) is allocated to TFCIs for a sub-set corresponding to services with lower transmission rate, and more resource (such as time-slot) is allocated to TFCIs for a sub-set corresponding to services with higher data transmission rate. It obviously shows that bits number occupied by TFCI is decreased.

[0022] In the situations mentioned above, it is possible that the receiving end needs to know the bits number of TFCI, coding mode of TFCI or other information. This can be done by directly judging the specific channel characteristics at receiving end. This also can be done by judging the sub-set through the specific channel characteristics, then determining the bits number or coding mode, etc., of the TFCI corresponding to the sub-set.

[0023] Based on the division of sub-sets and corre-

sponding relation between TFC and TFCI in a sub-set, the relevant TFC is obtained. Based on the sub-set type, the obtained TFCI is sent out by selecting appropriate coding algorithm and mapping mode of physical time-slot. A few coding algorithms can be used for TFC. For TFC in a sub-set corresponding to services with lower data transmission rate, the repetition code can be used. The ratio of total chips number of a time-slot to chips number occupied by TFCI in a time-slot is kept unchanged as much as possible. With these considerations, an appropriate time-slot structure is defined to simplify implementation of a system. In a spreading system, to simplify the system design, the spreading method of TFCI can be consistent with the spreading method of service data, or has a fixed spreading factor.

[0024] At the receiving end, the sub-set, where the TFC is located, is defined by the specific channel characteristics of the service. The channel characteristics can be number of time-slots, and/or spreading factor, and/or channels number, and/or data transmission rate, etc. This means that the sub-set, where the TFC is located, is determined by one or several channel characteristics. Naturally, channel characteristics (and characteristics used to divide the TFCS into sub-sets) that can be used to determine which sub-set the TFC is located are not limited to the examples listed above. They can be such as numbering of the time-slot, other characteristics or their combination and so on. The only requirement is that the characteristics used essentially define to the same sub-set as the characteristics used for dividing sub-sets do.

[0025] In the following, the invention is used in a fixed spreading factor situation.

[0026] Since number of time-slots in every frame can decide data transmission rate, number of time-slot for various TFC in a TFCS should be different. Therefore, number of time-slots occupied by the TFC can be used to divide the TFCS into sub-sets, then a TFCI - TFC index is created according to different sub-sets. Less number of bits is used to represent the TFC occupying less time-slots, and more number of bits is used to represent the TFC occupying more time-slots. With better setting TFCS and configuring TFCI - TFC, every time-slot can use a fixed number of bits (or chips) to represent TFCI.

[0027] In the following, an example is used for further description. A connection creates a TFCS, and it is supposed that the total number of the TFCS is *N*. According to the number of time-slots needed for every frame, there are *n* 1 TFC with one time-slot, *n*2 TFC with two time-slots and *n*3 TFC with three time-slots, ... etc. Suppose every time-slot uses a fixed *M* chips for TFCI coding, then for one time-slot, the indicating range of TFCI is *n*1, i.e., M (chips) --> *n*1. For two time-slots, it should be 2 x *M* (chips) --> *n*2, but not *M* (chips) --> *N*.

[0028] In general, less number of time-slots implements less number of TFC. When $n1 << N$, even blind format detection can be used. For minimum transmission rate of data , only one time-slot is allocated to every sub-frame and spreading factor is 16, then data transmission rate is 8.8 Kb/s. In this case, total number of TFC will be little. Therefore, the resource configuration is more reasonable, the accuracy is easier to guarantee and the update is more rapid.

[0029] For a sub-set with less number of time-slots, the repetition code can be used for TFCI coding.

[0030] If change of the spreading factor is seen as change of time-slots number, it is enough to spread the method mentioned above to the situation that has a changing spreading factor.

[0031] Along with changing of the spreading factor, the transmitted data are changed. Therefore, if the number of chips for TFCI is fixed and spreading mode of TFCI is same as spreading mode of data, the relative value of data rate and bits number of TFCI are unchanged. The method mentioned above also can be used.

[0032] In summary, it can be done as follow. The TFCI spreading mode applies the same method as data spreading to simplify the system. Number of chips occupied by TFCI in every time-slot structure is fixed. The corresponding relation of TFCI and TFC is defined according to number of time-slots and spreading factor, i. e., the TFCS is divided into sub-sets according to number of time-slots and spreading factor. When a system sets TFCS according to the service type, the procedure mentioned above can be considered to simplify dividing TFCS into sub-sets and creating corresponding relation between TFC and TFCI.

Claims

1. A transmission method of multiple services combination, comprising:

   during services initialization of communication, creating an identical transport format combination set (TFCS) which contains all transport format combination (TFC) at both transmitting end and receiving end;
   dividing the TFCS into no less than one sub-sets according to specific channel characteristics of services, and using transport format combination indicator (TFCI) to indicate TFC in a sub-set where the TFC is located;
   transmitting services according to the specific TFC in the sub-set, and transmitting the corresponding TFCI of the TFC simultaneously;
   defining the sub-set where the TFC is located according the services specific channel characteristics of this time, looking for the TFC in the sub-set by TFCI, and receiving services according to the found TFC.

2. The transmission method according to Claim 1,

wherein TFCI transmission mode of every sub-set is identical or different, which is bits mode, and/or code mode, and/or physical time-slot mapping mode.

3. The transmission method according to Claim2, further comprising:

   defining corresponding TFCI transmission mode according to specific channel characteristics of the services.

4. The transmission method according to Claim 1, wherein the different sub-sets of TFCS have overlap part or have not overlap part.

5. The transmission method according to Claim 1, wherein the specific channel characteristics of services that are used to divide TFCS into no less than one sub-set and the specific channel characteristics of services that are used to define a sub-set where the TFC is located at receiving end, are identical or different, but they essentially define to a same subset.

6. The transmission method according to Claim 1, wherein the specific channel characteristics of services, which are used to divide said TFCS into no less than one sub-set, are number of time-slots, and/or number of channels, and/or spreading factor, and/or data transmission rate.

7. The transmission method according to Claim 1, wherein the specific channel characteristics of services, which are used to define a sub-set where the TFC is located at the receiving end, are number of time-slots, and/or number of channels, and/or spreading factor, and/or data transmission rate.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN 01/01185

A. CLASSIFICATION OF SUBJECT MATTER

IPC[7]: H04M 11/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[7]: H04M 11/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 006 692 A1 (Siemens AG) 07.Jun 2000 (07.06.2000) See the whole document	1-7
A	EP 1 009 174 A2 (LG Electronics Inc) 14.Jun 2000 (14.06.2000) See the whole document	1-7
A	US 5 504 773 A (Qualcomm Inc) 02.Apr 1996 (02.04.1996) See Col.2-14, Fig.1-9	1-7

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30.Dec 2001(30.12.2001)	31 JAN 2002 (31.01.02)
Name and mailing address of the ISA/CN 6 Xitucheng Rd., Jimen Bridge, Haidian District, 100088 Beijing, China Facsimile No. 86-10-62019451	Authorized officer ZHAO JIANG Telephone No. 86-10-62093785

Form PCT/ISA /210 (second sheet) (July 1998)

TERNATIONAL SEARCH REPORT
Information patent family members

Search request No.
PCT/CN01/01185

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1 006 692 A1	07.06.2000	WO 00/33516 A1	08.06.2000
EP 1 009 174 A2	14.06.2000	None	
US 5 504 773 A	02.04.1996	SG 76465 A1	21.11.2000
		WO 93/14588 A1	22.07.1993
		AU 3 476 793 A	03.08.1993
		ZA 93/00290 A	26.01.1996
		NO 94/02670 A	16.09.1994
		EP 0 621 998 A1	02.11.1994
		FI 94/03410 A	16.09.1994
		JP 7 506 469 T	13.07.1995
		EP 0 730 356 A2	04.09.1996
		IL 104 412 A	14.11.1996
		BR 93/05758 A	28.01.1997
		CN 1 081 040 A	19.01.1994
		RU 2 116 696 C1	27.07.1998
		DE 6960 5953 E	10.02.2000
		ES 2 140 754 T	01.03.2000

Form PCT/ISA /210 (extra sheet6) (July 1998)